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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/038,556	01/04/2002	Elena M. Shembel	7053-1	7138

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EXAMINER

DOVE, TRACY MAE

ART UNIT PAPER NUMBER

1745

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/038,556

Applicant(s)

SHEMBEL ET AL.

Examiner

Tracy Dove

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 July 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office Action is in response to the communication filed on 7/19/04. Applicant's arguments have been considered, but are not persuasive. Claims 1-25 are pending and claims 26-36 have been canceled. This Action is made FINAL, as necessitated by amendment.

Election/Restrictions

Claims 27-36, drawn to a non-elected invention, have been canceled.

Claims Analysis

Note the specification states lithium batteries having polymer electrolytes are generally configured as gel-type polymer electrolyte which have liquid intermixed with a selected polymer electrolyte matrix material. The polymer electrolyte functions as a separator, being interposed between the cathode and anode films of the battery (page 5, lines 15-18). Thus, the modified polymer material of the present invention functions as a separator.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a chlorine containing polymer having an enhanced chlorine level, does not reasonably provide enablement for any halogen containing polymer having an enhanced halogen level. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. The specification does not provide any examples of specific polymer

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materials containing halogens other than chlorine (i.e., fluorine, bromine, etc). Polyvinyl chloride is the only halogen containing polymer material disclosed by the specification.

Claims 1-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a homogeneous solution (single liquid phase) of C-PVC, a salt of an alkali metal and an aprotic solvent, does not reasonably provide enablement for any homogeneous material (single solid phase or single gas phase) of C-PVC, a salt of an alkali metal and an aprotic solvent. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. Applicant states the added limitation "as a homogeneous material" is disclosed in the specification at page 21, lines 11-15. However, the specification specifically recites "a substantially homogenous *solution*". Furthermore, this is a product by process claim limitation since the polymer electrolyte of the claimed invention must be a gel electrolyte (heterogeneous solid/liquid phases). Specifically, the modified polymer is a solid material and functions as a separator. The aprotic solvent, by definition, is a liquid. Examiner points out the section cited by Applicant recites "after drying the thin C-PVC film, the film is ready for use in lithium batteries. The film is the solid modified polymer material of the claimed polymer electrolyte. The arguments provided on page 12 of the amendment are contradictory. Specifically, Applicant states "the polymer, the salt and the solvent are homogeneously mixed in solution" and then further states "a 100 mm thick electrolyte layer". The thickness limitation indicates a solid or gel electrolyte layer, not a homogeneous solution.

Claims 4, 5, 16 and 17 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a polymer electrolyte comprising 1) a chlorinated

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polyvinyl chloride, propylene carbonate (PC) and LiClO_4 having a conductivity of 0.01 S/cm^2 , 2) a chlorinated polyvinyl chloride, PC, DME and LiClO_4 having a conductivity of 0.108 S/cm^2 , or 3) a chlorinated polyvinyl chloride, PC, EC and LiPF_4 having a conductivity of 0.066 S/cm^2 does not reasonably provide enablement for any polymer electrolyte comprising a modified halogen containing polymer, a salt and an aprotic solvent having a lithium ion conductivity between 0.01 S/cm^2 and 0.108 S/cm^2 . - The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. Polymer electrolyte lithium ion conductivities for specific examples disclosed in the specification cannot be used to describe polymer electrolytes not encompassed by the specification example. Specifically, the application enables the specific lithium ion conductivity values disclosed in the examples only for the specific polymer electrolytes disclosed by the examples.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 6, 7 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6 recites the limitation "said modified polymeric material". There is insufficient antecedent basis for this limitation in the claim.

Claim 14 recites the limitation "said modified polymeric material". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 6, 8, 10, 12-15 and 18-22 are rejected under 35 U.S.C. 102(e)/103(a) as being anticipated by, and alternatively unpatentable over, Chia et al., US 6,617,078 B1.

Chia teaches a lithium ion rechargeable battery having a negative electrode, a positive electrode and a separator/polymer electrolyte there between comprising a chlorinated polymer. The polymer is comprised of a chlorinated polyvinyl chloride (col. 2, lines 10-18). The chlorinated PVC may be used alone or blended with a terpolymer of vinylidene chloride. Chlorinated PVC is a well known commercially available material. Preferably the amount of chlorine is at least 57 percent bound chlorine in the polymer. Chlorinated PVC resins of different molecular weights and chlorine contents are commercially available (col. 3, lines 6-33). The electrolyte comprises a lithium salt dissolved in a mixture of organic solvents. The lithium

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salt may be LiPF_6 , LiClO_4 , LiAsF_6 , LiPF_6 , and combinations thereof. The solvent may be ethylene carbonate, propylene carbonate, dimethyl carbonate, and combinations thereof (col. 4, lines 51-col. 5, lines 4). See also Example 1. The anode is a lithiated carbon material (col. 3, lines 2-5). The anode may be a carbon-based material and the cathode may be a metal oxide (vanadium pentoxide) or lithium transition metal oxide (lithium manganese oxide) (col. 4, lines 8-20). The cathode comprises the chlorinated polymer.

Thus the claims are anticipated. The claims are alternatively unpatentable. Regarding the limitation "a homogeneous material", the courts have ruled that product-by-process limitations, in the absence of unexpected results, are obvious. See MPEP 2113. Since the product of the claimed invention and the product of Chia are both polymer gel electrolytes (due to the aprotic solvent) having the same components, they appear to be the same.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 6-15 and 18-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Alamgir et al., US 5,252,413 in view of Chang et al., US 5,389,463 and/or in view of Chia et al., US 6,617,078 B1.

Alamgir teaches a lithium battery using lithium ion conductive solid polymer electrolytes composed of solvates of lithium salts immobilized in a solid organic polymer matrix. In particular, lithium batteries using solid polymer electrolytes derived by immobilizing solvates

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formed between a lithium salt and an aprotic organic solvent(s) in polyvinyl chloride (PVC) are disclosed (abstract). The solid electrolyte comprises 50-90 wt% of the aprotic organic solvent, 5-30 wt% of PVC and 5-15wt% of the lithium salt (col. 4, lines 7-11). Figure 2 depicts results for a Li/LiMn₂O₄ solid polymer electrolyte cell and Figure 3 depicts results for a carbon/ LiMn₂O₄ solid polymer electrolyte cell. The lithium salt may be LiPF₆, LiClO₄, LiAsF₆ or LiPF₆. The solvent may be ethylene carbonate, propylene carbonate or γ -butyrolactone (col. 3, lines 35-65). The negative electrode may contain a carbon material, lithium or a lithium alloy such as lithium-aluminum or lithium-tin. The positive electrode may contain MnO₂, V₆O₁₃, V₂O₅, lithium manganese oxide, lithium polysulfide, polypyrrole, polythiophene or polyacetylene (col. 4, lines 12-42).

Alamgir does not explicitly state the solid organic polymer matrix (separator) of the solid polymer electrolyte contains chlorinated PVC or a chlorinated PVC having 60-72 wt% chlorine.

However, Chia teaches a lithium ion rechargeable battery having a negative electrode, a positive electrode and a separator/polymer electrolyte there between comprising a chlorinated polymer. The polymer is comprised of a chlorinated polyvinyl chloride (col. 2, lines 10-18). The chlorinated PVC may be used alone or blended with a terpolymer of vinylidene chloride. Chlorinated PVC is a well known commercially available material. Preferably the amount of chlorine is at least 57 percent bound chlorine in the polymer. Chlorinated PVC resins of different molecular weights and chlorine contents are commercially available (col. 3, lines 6-33). The electrolyte comprises a lithium salt dissolved in a mixture of organic solvents. The lithium salt may be LiPF₆, LiClO₄, LiAsF₆, LiPF₆, and combinations thereof. The solvent may be ethylene carbonate, propylene carbonate, dimethyl carbonate, and combinations thereof (col. 4,

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lines 51-col. 5, lines 4). See also Example 1. The anode is a lithiated carbon material (col. 3, lines 2-5). The anode may be a carbon-based material and the cathode may be a metal oxide (vanadium pentoxide) or lithium transition metal oxide (lithium manganese oxide) (col. 4, lines 8-20). The cathode comprises the chlorinated polymer.

Furthermore, Chang teaches a polyvinyl halide having a halogen content of at least about 55 wt% of the polymer. The polyvinyl halide may be polyvinyl chloride. The polyvinyl halide can be a post-halogenated polyvinyl halide such as chlorinated polyvinyl chloride (CPVC). The chlorine weight content of the post-halogenated polyvinyl halide should be at least about 60%, with greater than 65% being preferred (col. 4, lines 40-col. 5, lines 15).

Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one of skill would have been motivated to substitute the chlorinated PVC of Chia or Chang for the PVC of Alamgir in order to improve the properties of the battery. The use of chlorinated PVC shows enhanced high temperature stability of the battery and mechanical integrity of the separator/polymer (Chia; col. 3, lines 6-33). Chang teaches chlorinated PVC has high tensile strength and ductility (col. 3, lines 9-25). Alamgir, Chia and Chang all teach PVC materials for the separator/polymer matrix of a battery. Chia teaches that chlorinated PVC is a well known commercially available material for a battery separator/polymer matrix with different molecular weights and chlorine contents available. Chang teaches post-chlorinated PVC is a known material for use as a battery separator. Thus, one of skill would have found it obvious to substitute chlorinated PVC for the PVC of Alamgir because Chia and Chang teach chlorinated PVC is a well known battery separator/polymer matrix material.

Regarding the chlorine content of the chlorinated PVC, Chang teaches the chlorine weight content of the post-halogenated polyvinyl halide should be at least about 60%, with greater than 65% being preferred. Chia teaches chlorinated PVC with an amount of chlorine of at least 57 percent and chlorinated PVC resins of different molecular weights and chlorine contents are commercially available.

Regarding the limitation "as a homogeneous material", the courts have ruled that product-by-process limitations, in the absence of unexpected results, are obvious. See MPEP 2113. Since the product of the claimed invention and the product of the prior art are both polymer gel electrolytes (due to the aprotic solvent) having the same components, they appear to be the same.

Response to Arguments

Applicant's arguments filed 7/19/04 have been fully considered but they are not persuasive.

35 U.S.C. 112, first paragraph

Applicant argues that it is well known that the chemical properties of the various halogens are quite similar, and thus generally interchangeable. Applicant states one having ordinary skill in the art in possession of Applicant's specification would recognize the invention can be practiced with halogen containing polymers such as polyvinyl fluoride and polyvinyl bromide, in view of the disclosed halogen containing polymer polyvinyl chloride. However, this argument is not commensurate in scope with the claimed invention. While Examiner agrees the specification enables polyvinyl chloride and may enable other polyvinyl halogen polymers, the specification does not enable one of skill to use any of the numerous halogen containing

polymers. Examiner emphasizes that the specification does not enable any polymer containing a halogen constituent to be used as a polymer electrolyte.

35 U.S.C. 112, second paragraph

All 35 U.S.C. 112, 2nd, rejections contained in the Office Action of 2/12/04 have been withdrawn.

35 U.S.C. 102(b) in view of Chang (US5,389,463)

Applicant states "claim 1 was rejected under 35 U.S.C. 102(b) as being anticipated by...Chang". This is incorrect. Claim 26, not claim 1, was rejected under 35 U.S.C. 102(b) as being anticipated by Chang. Since claim 26 has been canceled, the anticipation rejection in view of Chang has been withdrawn.

35 U.S.C. 102(e) in view of Chia (US6,617,078)

Applicant argues that Chia teaches a two phase electrolyte and that no lithium ion conductivities are disclosed by Chia. Both Chia and the claimed invention teach a two phase electrolyte wherein a chlorinated PVC polymer is a solid and an aprotic solvent is a liquid. Therefore, this argument is not persuasive. The electrolyte of Chia is a lithium-ion conducting polymer membrane which acts both as the separator and as the electrolyte (2:53-56). Chia does not teach any specific lithium ion conductivities for the polymer electrolyte, however, claims 4, 5, 16 and 17 were not rejected as being anticipated by Chia. Therefore, this argument is not persuasive.

35 U.S.C. 103(a) of Alamgir (US5,252,413) in view of Chia and/or Chang

Applicant disagrees with the motivation to combine the cited prior art and presents arguments regarding lithium ion conductivities. However, the motivation statement provided by

the Examiner did not recite anything about lithium ion conductivities. Examiner stated the use of chlorinated PVC shows enhanced high temperature stability of the battery and mechanical integrity of the separator/polymer (Chia; col. 3, lines 6-33). Furthermore, the claims containing limitations regarding lithium ion conductivities have not been rejected in view of the prior art.

Applicant's argument regarding the teachings of Alamgir are confusing. Applicant states that the impressive results which approach the extremely high ion conductivities demonstrated by Applicants, are achieved using unmodified PVC. Applicant appears to be arguing that one of skill would not have been motivated to use the C-PVC of Chia or Chang for the PVC of Alamgir because the lithium ion conductivity would not be improved. This is confusing considering the instant specification states "the polymer electrolyte formed from the modified (halogen enhanced) polymer material can improve the ionic conductivity of the polymer electrolyte (page 8, lines 9-17) and the fact that enhancing the halogen level of PVC increases lithium ion conductivity is the present inventive concept.

Applicant's argument that "the lack of reported Li ion conductivities reported by Chia suggests marginal results" is simply unfounded. The argument that "the expected low Li ion conductivity obtained from a hypothetical electrolyte based on Chang which would indicate to one having ordinary skill in the art at the time the invention that use of C-PVC instead of conventional PVC would degrade the $10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}$ at room temperature Li ion conductivities provided by the electrolytes disclosed by Alamgir" is likewise illogical and unreasonable.

It is important to point out that the PVC or C-PVC polymers of the prior art are not the only component of the polymer electrolyte that effects lithium ion conductivity. Specifically, the

lithium salt and/or aprotic solvent significantly effects the ability of the polymer electrolyte to conduct lithium ions.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday-Thursday (9:00-7:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read "Tracy Dove", is positioned above the printed name.

Tracy Dove
Patent Examiner
Technology Center 1700
Art Unit 1745

October 1, 2004